

# PATENT SPECIFICATION

NO DRAWINGS

1,104,337

1,104,337



Date of Application and filing Complete Specification: March 4, 1965.  
No. 9350/65.

Application made in United States of America (No. 351565) on March 12, 1964.  
Complete Specification Published: Feb. 21, 1968.

© Crown Copyright 1968.

Index at acceptance: —C3 C(1B1, 1C, 1D, 1X); B2 E(1A, 1H); C3 F(1B2, 2C, 2F, 2G, 3A); C3 P(2C4B, 2C13A, 2D1A, 2D2A, 2F2, 2K7, 2T2A, 7C4B, 7C8B, 7C8C, 7C13A, 7C13B, 7C20B, 7D2A1, 7F2, 7K2, 7K8, 8C4B, 8C8B, 8C8C, 8C13A, 8C13B, 8C20B, 8C20D1, 8D2A, 8D2B2, 8D3A, 8F2, 8K7, 8K8, 10C4B, 10C8B, 10C8C, 10C10, 10C12B, 10C13A, 10C13B, 10C16B, 10C16C, 10C18, 10C20D1, 10C20D3, 10D1A, 10F2)

Int. Cl.: —C 08 j 1/30

## COMPLETE SPECIFICATION

### Improvements in or relating to Cellular Surface-coating Compositions

We, THE SHERWIN-WILLIAMS COMPANY, a Corporation of the State of Ohio, United States of America, of 101 Prospect Avenue, N.W., Cleveland 1, Ohio 44101, United

5 States of America, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—  
10 This invention is for improvements in or relating to cellular surface-coating compositions.

An object of this invention is to provide a liquid coating composition, which may be applicable by spray means, comprising organic polymeric foam particles in a variety of physically distinct forms, so as to provide acoustical and thermal insulating properties and which may also be decoratively useful to obtain 20 multicoloured and textured decorative effects suggestive of woven fabrics and tapestry.

According to the invention there is provided a liquid coating composition comprising a plurality of pre-formed particles of 25 organic polymeric multi-celled foam, preferably pre-pigmented, and preferably also containing flock or short fibres in combination therewith, dispersed in a liquid vehicle binder phase comprising a volatile liquid and a dense 30 non-volatile film-forming adhesive phase which is preferably substantially free from colour bodies and which acts as binder for the foamed particles.

The vehicle employed is preferably of the 35 oil-in-water emulsion type in which the film-forming binder solids or non-volatile vehicle is of itself more or less colourless and forms the dispersed phase of an oil-in-water emulsion. Upon evaporation of the volatile

aqueous vehicle portion from a wet spray 40 coat, the foamed particles are deposited in a continuous, sometimes botrious, layer in the non-volatile adhesive polymer.

In order to provide the requisite colour 45 effects, the film-forming binder solids should be substantially free from colour bodies and should not have a colour darker than provided by the Gardner-Holdt colour scale for varnishes. Bitumens and tars obscure the multicolour pattern offered by the pigmented 50 foam particles. Substantial interference with the colour effects developed by the deposited individually-visible foam particles is to be avoided. The colour of the coating is thus largely determined by the pigmentation of the 55 foamed particles used. The coated surface may be monochrome or multi-coloured, and various effects may be obtained by suitably selecting the colour of the particles, the size of the particles, the texture of the particles and their ratios employed in formulation. Fibre or flock content, above a minimum 60 amount, can also be effective. Coatings produced from the compositions of this invention may also differ substantially in texture and appearance, depending upon variables in composition as suggested above. As herein-after shown, the physical nature of the foamed 65 particles may differ greatly, depending upon the process employed in their manufacture, thus a wide variety of novel, beautiful and useful coatings may be obtained by the combinations suggested.

70 By employing techniques, some of which are known in the art, it is possible to foam most of the known and available organic polymers whether they are thermoplastic or thermosetting. Some organic polymers have 75

attained the greatest usage because of their desirable properties as foams and these include rubber, polyurethane, polyvinyl chloride, polystyrene, urea-formaldehyde condensation products, polyethylene and polypropylene. Techniques for moulding, extrusion and foaming *in situ* have been suggested as means for producing useful foamed products, but as specialised and costly equipment has been required for foam production and fabrication, use of these techniques is limited.

Foams are often produced by incorporating a blowing agent into thermoplastic polymers. Under controlled conditions of temperature and pressure, the agents decompose to release a gas and create cellular gaseous cell structures. Gas liberation and cell formation may also originate from chemical reaction between reactive additives incorporated in the polymer-foam formulation. Polyurethane foams are formed instantaneously because during the polymerisation reaction reactive isocyanate groups react with water to form carbon dioxide. Foams have also been prepared by mechanical means whereby the basic pre-polymeric material is frothed mechanically, poured into moulds and heat cured. Latex foams may be produced by this method.

Blowing agents may be divided into two general classes, both of which are operative under the influence of heat. Physical blowing agents may be either gases or liquids that function without chemical change. Chemical blowing agents are normally solid organic or inorganic compounds which decompose at elevated temperatures to yield gaseous products. Less often, foams are produced by introducing gases under pressure into polymeric substances. Foaming occurs upon pressure release as in the case of extruding the polymeric blend through a die into a zone of lesser pressure. Liquid blowing agents are converted from the liquid to the gaseous phase by heating subsequent to incorporating them into a polymeric matrix. Selection of the method of foaming plastic solids depends upon processing equipment as well as the nature of the material to be foamed. Generally, it is required that the blowing agent decompose or function within a temperature range in which the polymeric substance has flow characteristics.

In the prior art, foams have been applied to surfaces by foaming *in situ*. Foamed coatings have been applied to sheet materials such as cloth or metal by spraying, knife coating or roller coating. Sheet material having the appearance and "feel" of leather is made by applying a coating of a vinyl foam formulation to a fabric base and laminating a solid vinyl sheet over the top of said coating. The assembled coated sheet is then passed through an oven at a temperature of about 380°F.

Polyurethane foams, *per se*, have also been

employed in the coating of sheet materials but, in addition they have been adapted to "on site" application of coatings to large surfaces such as walls and ceilings. In polyurethane coating, on site, it is convenient to apply liquid polyurethane-forming reactants using a special spray gun which mixes the polyurethane-forming liquid reactants either in the gun or in the instant the polyurethane foam components leave the gun. Polyurethane foams coatings are not simple to produce, require extensive control and expensive equipment and there are toxic hazards. Hence, their use is confined primarily to factory conditions.

In the formulation of coating compositions according to this invention, selection of the foamed particle component is unlimited by class of chemical compounds, but, rather by the need for certain physical characteristics essential to fulfil requirements for specific purposes. For example, the composition of the foamed particle component of this invention is not limited to particular organic polymers, *per se*, but the operability of a foamed polymer particle for the purpose of this invention depends in very large measure upon particle size range control, pigmentation, foam density, open and closed cell content, and other physical qualities of the foam particles.

Broadly, the liquid vehicle component of this invention must serve as a medium for continued suspension of the foamed particles in a liquid form suitable for application. In order to obtain lightest densities, the adhesive binder in emulsified form prevents excessive wetting and penetration of the vehicle solids into the voids of the foamed particles and thus avoids the loss of the benefits arising from the multicellular nature of the foamed particles.

Several methods have been employed in the manufacture of foamed particles useful for the purposes of this invention. One method involves mechanically shredding a biscuit of bulk foam to within the required particle size range.

A second method involves first dividing the polymeric foam precursor into fine particles. These foam precursor particles are heated to cause foaming and to complete and stabilise the polymeric foam particle through fusion or polymerisation. The polymeric foam in particulate form precursor particles as originally produced must be small to begin with to allow for expansion due to additional foaming due to heating without exceeding an operative particle size range since, of course, large foam particles will not pass through the orifices of a spray gun, for example.

The maximum particle size of foamed particles useful in the practice of this invention is, for practical purposes, limited by the size of commercially available orifices through which the liquid coating is delivered during

70

75

80

85

90

95

100

105

110

115

120

125

130

5 spray application. Foamed particles of 3/32 in. diameter are about the maximum size which may be employed in liquid coatings when applied through commercially available spray equipment. Obviously, equipment may be designed especially to overcome this limitation, but we desire to eliminate the need for specialised equipment. The lower limit of foam particle size is less critical, 10 however, and depends for best results upon the particles being individually discernible by the human eye and particles of 1/128 inches in diameter have been satisfactorily used. 15 Microscopic foam particles have obvious advantages and are not to be precluded from the scope of our discovery.

20 Coatings employing foamed particles having sizes varying within very broad ranges are eminently useful, although more textured coatings employing particles of the upper range limit may be preferable for specific purposes. Coatings employing foamed particles having diameters within the range of 1/128 to 3/32 of an inch have been successfully applied using conventional paint spray equipment.

25 Of course it is understood that in another, but less preferred, embodiment of this invention the liquid vehicle and foamed particle components of the coating may be sprayed from separated orifices in coating proportions whereby the foamed particles and flock are carried in a stream of air and mixed with the liquid vehicle spray in the air stream exterior of the gun, but prior to deposition on a substrate. This method is not precluded.

30 Polyurethane foams of open cell and low density have, for example, been easily shredded. Completed plastisol foams are often 35 more difficult to shred. Polyethylene and polypropylene foams as at present available are not adapted to easy shredding.

40 Two modifications were made over standard methods of preparation of plastisol foams. One useful modification provides a means wherein about 20 parts of a liquid, non-fused polyvinyl chloride plastisol mixture containing a foaming agent is mixed with about 80 parts of common table salt. The 45 plastisol-salt mixture is baked in a pan to form a cake of fused and foamed plastisol.

50 After cooling, the friable salt cake of foam produced can be broken into smaller pieces and fed into a mechanical shredder. Shredding this material into particles of requisite size range required only 1/50th the time previously required to shred an equivalent quantity of plastisol foam when the salt was absent. The shredded foam particles were 55 thoroughly washed in water to remove most of the salt. Portions of the salt may remain entrapped or encapsulated in the plastisol but this may well be permissible for some purposes. While primarily, salt assists in grinding the plastisol, it also serves, when removed 60 by solution in water, to leave additional voids in the organic polymer particles which contribute to the cellular structure of the foam, to reduce the apparent density of the particles and to introduce texture variation in the final films.

65 A second useful modification involves addition of about an equal amount of water to a liquid foam plastisol composition containing a blowing agent, while employing sufficient high speed agitation to form a fine dispersion of the components. Subsequent baking in a cake form, as before, produced a fused plastisol foam which crumbled easily in the hand and was rapidly shredded to small particle size at modest energy consumption. Foam particles produced by this method initially contain considerable moisture. While in a water-wetted condition the foamed particles are readily incorporated into aqueous emulsion (latex) type paint vehicles. However, if required, moisture may be removed from the shredded particles of foam by drying.

70 Particulate foam particles produced according to the preceding method have low tensile strength. Coatings produced employing these particles have less abrasion resistance than coatings employing particles produced according to the other methods described herein where comparable binder vehicles are employed. Improvement in strength is obtained by a second heating step. Thermoplastic particles thus are increased in tensile strength before use in the fluid binders of this invention.

75 The rate at which shredding of plastisol foam can be achieved is increased by reducing the temperature of the foam to the point of brittleness. In the frozen or brittle state, the foam can readily be ground into required particle size ranges.

80 In the partial fusion technique referred to above, a subsequent foaming and complete fusion of the pre-formed foam precursor particles produces foam particles characterised by the presence of a continuous or nearly continuous film or outer skin surrounding each foamed particle. Foamed particles so produced are substantially closed cells impermeable to liquids, even though the foam itself has interconnecting adjacent voids or cells (open cell structure). Particles within the desired size range of non-permeable nature, whether due to the presence of an outer skin or closed cell foam construction requires less binder solids and liquids than those which are permeable or semi-permeable. Obviously, vehicle absorbed in the interiors of foamed particles exhibits little of its intended binder function. Additionally, sound and thermal insulation value is lost. In many cases closed celled particles or those having substantially impermeable outer skins are preferred for purposes of the invention. Foamed particles having both open and closed cells and those hav-

85 90 95 100 105 110 115 120 125 130

ing all open cells are also useful and not to be precluded. For example, when flexible open cell polyurethane particles are combined with a latex vehicle as herein illustrated, the latex solids appear to migrate to the top of the coating after application of the coating to a substrate. Thus, acoustical and insulating properties of the coating are largely preserved due to the slight penetration of the binder vehicle into the cells.

A process analogous to "shorting" has also been employed to produce foamed plastisol spheroids. Spheroids are formed by extruding minute droplets of liquid plastisol containing a foaming agent into a hot liquid bath, in which liquid the plastisol is insoluble. Dropping the individual droplets from a distance of about 10 feet above the bath from a hypodermic needle which had been cut short and squared off has been practiced to produce trial quantities of pre-pigmented vinyl plastisol foam particles. Best results were obtained using a polyoxyalkylene glycol bath at temperatures of the bath in a liquid state maintained at about 350°F. After dropping from the needle, 30 to 60 seconds immersion produced useful solid foamed plastisol particles from the liquid mixture. A bath temperature of about 400°F. caused the solid foamed plastisol particles to jell together in a large mass on the surface, while a bath temperature of 300°F. resulted in incomplete foaming of the plastisol particles. Thus, the temperature of the bath was found to be a critical factor in the success of the method, depending upon the nature of the formulation of the plastisol. The foamed particles produced in this manner were relatively uniform in size, having an average diameter of about 1/16 inches.

Subsequent to removal of the particles from the bath, excess bath material adhering to the surface of the particles were removed by a water wash.

A more economical method of producing foamed plastisol particles was obtained by heating a liquid latent-foam pigmented plastisol at a temperature at which the plastisol partially fused without activating the blowing agent. This step can be conveniently carried out in shallow trays.

The partially fused cake of pigmented plastisol is cooled, the mass broken or cut into smaller pieces, then shredded. The fine particles so produced are returned to a heated liquid bath in which the plastisol is insoluble, and the fusion of the individual particles completed and the blowing agent activated at a temperature of 350°F. for 30-60 seconds.

Particles so formed are also water washed to remove bath material.

The botryoidal foamed plastisol particles thus produced possess an impermeable outer skin with cellular interior similar to the spheroidal particles described above. Control

of particle size is obtained by classification after shredding and before the blowing and final cure step.

Still another useful method of producing foamed particles is to spray fine droplets of pigmented liquid plastisol into a large heated chamber. Atomised particles are maintained in suspension by upwardly directed streams of heated gas. Temperatures within the chamber are sufficient both to fuse and foam the suspended particles during residence time in the chamber. Cooled particles settle out in an ante-chamber and are collected for use.

Particles produced by each of the above methods have distinctive physical appearance. It is anticipated that each method may be meritorious over the other for various different purposes. Each of the various types of foamed particles produce coatings which have characteristic appearance and texture in the dried film state. Two or more different types of particles may be blended in coating formulations to achieve variations in texture. Variations in colour, as well provide means to formulate coatings having an almost infinite variety of decorative influence.

From a colour stability standpoint, it is preferred to use pigments rather than dyes as means for introducing colour in the foamed particles. Inorganic pigments are generally more stable under heat and ultraviolet radiation than are dyes, and for this reason are preferred. In any event, the principal attribute of decorative value of the particulate foam particle comes about by its inherent colour through pre-pigmentation and the variety of texture through the variety of methods of manufacture of the foam particles.

In the formulation of the coating compositions of this invention, the foamed particles can be roughly considered similar to pigments as they are used in conventional paint formulations. A wealth of binder vehicle classes well known in the paint art may be emulsified for use as binder in this invention. However, distinct advantages are to be found in the use of emulsion polymers or latex vehicle solids binders in the practice of this invention.

Paint latices and vulcanisable adhesive rubbery liquid latices, including products made by emulsion polymerisation of one or more monomers in water systems and natural rubber latices, are widely available from a number of sources for use as the vehicle component of this invention. In oil-in-water systems, fire hazard is eliminated.

The term short fibres or flock as used herein encompasses the generally soft, fluffy fibres recovered from wool, cotton, rayon or other material and synthetic fibre manufacture and may even embrace cotton linters, all of which are short-fibres. We particularly prefer a synthetic fibre flock sold under the

trade mark "Acrlan", generally not appreciably longer than 1/16 inch.

The following examples are given to illustrate the manner in which the above-described invention may be carried into effect. Examples I to VI concern the preparation of the foamed particles, and Example VII to XII describe compositions according to the invention.

EXAMPLE I Foamed Plastisol Composition		Parts by Weight
Diphenyl 2-ethylhexyl phosphate	200.00	
Polyvinyl chloride resin	400.00	
Azodicarbonamide	12.40	
Polyester plasticiser Mol.Wt. 3500	11.60	
Total	624.00	

The above ingredients were pre-mixed in a paste mixer. The viscous mixture was subject to further high shear on a roller mill to disperse the polyvinyl chloride resin and azodicarbonamide (blowing agent) particles present and to achieve a more intimate mixture of liquid and solid ingredients.

The paste thus obtained from the roller mill was further thinned with the following solution:

		Parts by Weight
Diphenyl 2-ethylhexyl phosphate	200.00	
Barium-cadmium laurate	20.00	
Total	220.00	

More or less of the thinning liquid than indicated above may be incorporated to adjust the viscosity of the batch to the needs of the particular dispersing equipment employed. Generally, different types of dispersing equipment vary with respect to the viscosity suitable for optimum dispersion.

Coloured particles were obtained here by mixing various coloured pigments (ground in plasticiser) with the above indicated clear foam plastisol composition. For example, a white foam plastisol was made by using 10 per cent of the following pigment paste mixed into clear pre-foam plastisol liquid.

		Parts by Weight
Rutile titanium dioxide	70	
Diethyl phthalate	26	
Chlorinated biphenyl	2	
Total	98	

A black foam plastisol was made using 3 per cent of the following pigment paste in the base plastisol liquid.

Parts by Weight
Furnace Black
Diethyl phthalate
Total

A red foam plastisol is produced using six per cent of the following ground pigment paste in admixture with the basic clear pre-foam plastisol composition.

Parts by Weight
Medium cadmium red
Diethyl phthalate
Chlorinated biphenyl
Total

In like manner, 6 per cent of the following ground pigment paste has been employed to produce a green foam plastisol.

Parts by Weight
Chrome oxide green
Diethyl phthalate
Total

#### EXAMPLE II

The liquid foam plastisol from Example I was poured into pans and placed in an oven at 400°F. for about 20 minutes. The thermoplastic vinyl chloride resin particles are softened at this temperature and are solvated by the diphenyl 2-ethylhexyl phosphate plasticiser. The liquid plastisol fuses into a solid mass and at the same time the blowing agent is thermally decomposed causing expansion of the resin. The resulting plastisol foam is a tough rubber-like mass. The cooled mass was cut into one inch cubes, loaded into a Wiley Mill and shredded. The shredding chamber of the Wiley Mill contains 6 stationary cutting bars and 4 rotating cutting bars mounted on a central shaft. The rotating cutting bars are powered by a 1/3 H.P. motor through a V-belt pulley system to increase the speed of rotation of the cutting units to 5,000 revolutions per minute. Clearance between the stationary and rotating cutting bars is set at 1/64 inch. Maximum particle size of the output of the Mill was about 1/16 inch in its largest dimension.

Parts by Weight
80 parts by weight of salt (sodium chloride)
was mixed with 20 parts by weight of the liquid foam plastisol of Example I. This mixture was poured into pans, baked for 20 minutes at 400°F. to fuse and foam the liquid plastisol. The resulting foam slab was cooled and reduced to small chunks and shredded as in Example II. The salt impregnated foam ground more rapidly in the Wiley Mill than the prior material (rate 50 times faster). The

shredded particles were then washed with water to remove leachable salt. Some small portion of the salt remained encapsulated in the plastisol. The completed washed and dried 5 foam particles were primarily in the 1/64th to 1/32 in. diameter particle size range with a minor proportion of a smaller particle size.

**EXAMPLE IV**  
The liquid foam plastisol of Example I 10 was mixed with an equal volume of water and a dispersion obtained by means of a high speed mixer. The plastisol-water mixture was poured into a pan and baked at 375°F. for 20 minutes. In addition to fusing 15 the plastisol, the baking operation activated the blowing agent and converted water to steam. The foregoing procedure produced a mass of plastisol foam which was very crumbly. The mass broke up into small particles when rubbed between the fingers. Reduction in particle size of this mass in the 20 Wiley Mill was accomplished at a faster throughput rate than any of the previous examples. The particle size distribution ranged 25 between 1/128 in. to 1/16 inch with a predominant proportion of particles in the lower portion of the range.

**EXAMPLE V**  
To produce foamed plastisol spheres the 30 variously coloured liquid pre-foam plastiols of Example I were individually forced under pressure through a hypodermic needle cut off square at the end to aid the formation of the smallest droplets possible. The plastisol droplets as they formed were dropped off the end of the hypodermic needle, allowed to fall 6 to 10 feet into a bath of polyoxyethylene glycol heated to a temperature of 350°F. In from 30 to 60 seconds the plastisol droplets 40 were foamed and fused forming spheres having a smooth outer skin and a diameter of about 1/16 inch. The spheres thus formed were removed from the bath by straining and washed with warm water to remove water 45 soluble contaminant from the bath.

Droplet size and hence the size of the completed foamed plastisol particle is dependent upon the size of the hypodermic needle used.

**EXAMPLE VI**  
Foamed plastisol particles having an outer skin as in Example V but irregular in shape 50 were produced by pouring the liquid foam plastisol of Example I into aluminium pan and baking at a temperature of 220°F. for 20 minutes to partially fuse the plastisol without activating the blowing agent. Thereafter the fused plastisol cake was allowed to cool, broken into smaller pieces and shredded in 55 the Wiley Mill. The partly fused plastisol lacked much of the toughness and resiliency of the completely fused material and, therefore, shredding was accomplished quickly in 60

the mill. The shredded particles obtained were then placed in a hot polyoxyethylene glycol bath, at 350°F. to completely fuse the particles and to decompose the blowing agent to foam the masses. In approximately 2 minutes the particles were strained for removal from the bath and washed with water to remove any polyglycol film adhering to the particles. The particles were irregular in shape with a particle size from about 3/32nds to 1/64th of an inch, the most numerous particles being about 1/16th inch.

65  
70  
75

**EXAMPLE VII**  
Latex Vehicle Blend.

	Parts by Weight	
Water	50.00	80
Ammonia 29%	2.00	
Wetting Agents	11.00	
Aliphatic Sulphonate 73%		
Alkyl Aryl Polyglycol 27%		
Hexylene glycol	8.00	85
Latex	488.00	
Acrylic Resin 45%		
Water 55%		
Hydroxyethyl Cellulose Soln.	171.00	
Ethylene glycol	9.25	90

(The acrylic resin was an emulsion interpolymer of methyl methacrylate and 2-ethyl hexyl acrylate).

To prepare a foamed coating using the above latex vehicle blend, one adds approximately 100 parts by weight of foamed particles as described in the prior Examples to 150 parts of vehicle. A specific coating composition prepared by mixing 100 parts by weight of foamed particles produced according to Example III to 150 parts of the above latex vehicle in the following proportions:

	Parts	
Red Pigmented Particles	33-1/3	
White Pigmented Particles	33-1/3	105
Blue Pigmented Particles	33-1/3	

**EXAMPLE VIII**  
Latex Vehicle Blend

	Parts by Weight	
Water	406.00	110
Hexylene glycol	16.00	
Hydroxy ethyl cellulose, 2% aqueous solution	342.00	
Latex	976.00	115
Vinyl Acrylic Copolymer 45%		
Water 55%		
Boric acid	4.00	

(The vinyl acrylic copolymer was an emulsion interpolymer of a major proportion of styrene with a minor proportion of butyl acrylate).

The above latex vehicle blend produced foamed coatings which were tougher and more

120

5	<b>EXAMPLE IX</b> <b>Latex Vehicle Blend</b>			
10	Water	217.00	Parts by Weight	65
10	Latex	596.00	50% Zinc Oxide (Aqueous Dispersion)	53.00
	Ethyl acrylate-acrylonitrile copolymer 45%		50% Zinc dibutyl-dithiocarbamate	11.00
	Water 55%			
15	Sodium carboxymethyl cellulose	4.50		
15	To the above latex vehicle blend mix:			
20	Ground flexible Polyurethane Foam Dark Grey	78.00	The foamed coating composition obtained by thoroughly blending together the above ingredients was applied to the interior of an automobile boot by spray application.	70
20	Plastisol Foam Particles of Example VII			
	Pigmented White	30.00	A film thickness of about 1/32 inches was uniformly applied. Forced drying of the applied coating was obtained in conveying through an oven at 285°F. Vulcanisation of the deposited latex vehicle was assisted by an additional pass through the oven after the water had evaporated from the coating where	75
	Acrlan Flock 3.0 Denier (Length per Filament=0.020 in.)	24.00	in the temperature of the metal substrate reached 285°F., the ambient temperature of the oven. Exposure was approximately 60 minutes at 285°F.	80
25	The polyurethane foam employed in this example was of the flexible open celled type having a density of 2 lbs. per cubic foot and was shredded to a particle size of about 1/32 in. The flock serves to strengthen and reinforce films of the coating and may carry colour.			
	<b>EXAMPLE X</b>			
35	A foamed coating composition was prepared according to Example IX in which styrene butadiene latex (45% resin solids) was substituted for the ethyl acrylate-acrylonitrile copolymer latex.			
	<b>EXAMPLE XI</b> <b>Latex Vehicle Blend</b>			
40	Neoprene Latex (Latex 571)	528.00	Parts by Weight	85
	Water	193.00	Polymeric acrylic ester	20
45	10% sodium salt of sulphuric acid ester of a mixture of lauryl and myristyl alcohols (Aquarex D Solution)	13.00	High flash naphtha	80
	73% sulphur dispersion	3.60		
50	55% Sym. di-betanaphthyl para-phenylene-diamine (Age Rite White Dispersion)	4.80	(The polymeric acrylic ester was that sold under the Registered Trade Mark Acryloid 1366, believed to be an emulsion interpolymer of 40% methyl methacrylate and 60% butyl methacrylate).	90
	To the above vehicle blend mix:			
55	Ground Flexible Polyurethane Foam Dark Gray (1/32—1/16 particle size)	78.00	A particulate foam coating composition was prepared by mixing three parts of foamed particles prepared according to Example II with two parts of the above acrylic resin solution.	95
	Plastisol Foam Particles of Example VII (Pigmented White)	30.00		
60	Acrlan Flock 3.0 Denier	24.00	While the preferred forms of the invention in the foregoing examples illustrate both the presence and the absence of fibres or flock, it has been our experience that the use of flock markedly enhances the performance of the coatings in actual use, overcoming a tendency to leave small holes or voids through the films on application. In the preferred quantities, little change of appearance of the film can be detected when flock is used when held to a level producing the requisite film quality improvement. However, one may elect to change the general film appearance by increasing the flock content above that found essential to greatly enhance film quality, and in such instances colour in the flock becomes a useful means of variation.	100
	The following vulcanising agents were not			105
				110
				115
			<b>WHAT WE CLAIM IS:—</b>	
			1. A liquid coating composition comprising a plurality of pre-formed particles of organic polymeric multi-celled foam dispersed in a liquid vehicle comprising a volatile liquid and a dense non-volatile film-forming adhe-	120

sive phase which acts as a binder for the foam particles.

2. A composition according to claim 1 wherein the foam particles are pigmented.

5 3. A composition according to claim 1 or claim 2 wherein the said liquid vehicle is substantially free from colour bodies.

10 4. A composition according to any one of the preceding claims wherein flock or short fibres are admixed with the foam particles.

15 5. A composition according to any one of the preceding claims wherein the foam particles have a maximum dimension of 3/32 of an inch.

20 6. A composition according to any one of the preceding claims wherein said liquid vehicle is an oil-in-water emulsion of the film-forming adhesive.

25 7. A composition according to claim 6 wherein the film-forming adhesive is a latex polymer.

8. A composition according to claim 7 wherein the latex polymer is a vulcanisable natural or synthetic rubber and is used in admixture with a vulcanising agent therefor.

25 9. A composition according to claim 8 wherein said synthetic rubber is a neoprene rubber.

30 10. A composition according to any one of the preceding claims wherein the foam particles are formed from a polyvinyl chloride.

11. A composition according to any one of the preceding claim wherein the foam particles are formed by shredding a foamed mass of organic polymeric material.

35 12. A liquid coating composition having foam particles dispersed therein substantially as described in any of Examples VII to XII.

13. A process for the manufacture of a liquid coating composition containing foam particles of an organic polymer dispersed therein which comprises forming small particles of a multi-celled foamed organic poly-

mer and dispersing said particles in a liquid vehicle binder comprising a volatile liquid and a dense non-volatile film-forming adhesive phase.

14. A process according to claim 13 wherein said liquid vehicle is an oil-in-water dispersion of a film-forming natural or synthetic organic polymer.

15. A process according to claim 13 or 14 wherein said foam particles are pigmented.

16. A process according to claims 13 to 15 wherein said foam particles are produced by shredding a mass of the foamed organic polymer.

17. A process for the manufacture of a liquid coating composition substantially as described in any of Examples VII to XII.

18. A liquid coating composition when manufactured by the process claimed in any one of claims 13 to 17.

19. A method of forming the liquid coating composition claimed in any one of claims 1 to 11, which method comprises spraying the liquid vehicle and foamed particles components of the composition in the required proportions from separated orifices of at least one spray gun, whereby the foamed particles are carried in a stream of air and mixed with the liquid vehicle spray in the air stream exterior of the gun but prior to deposition on a substrate.

20. An article coated with a coating composition comprising a plurality of pre-formed particles of organic polymeric multi-celled foam dispersed in a dense, non-volatile adhesive film which acts as a binder for the foam particles.

STEVENS, LANGNER, PARRY &  
ROLLINSON  
Chartered Patent Agents  
Agents for the Applicants.